

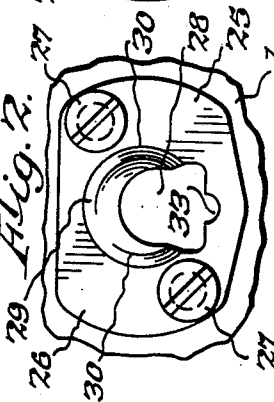
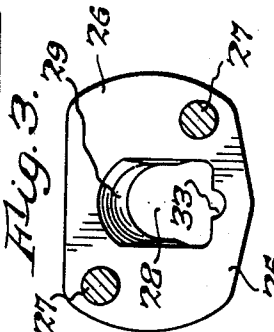
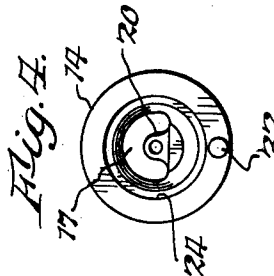
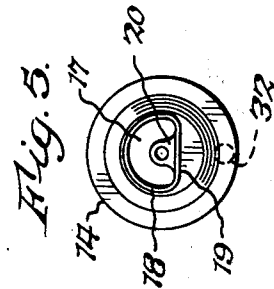
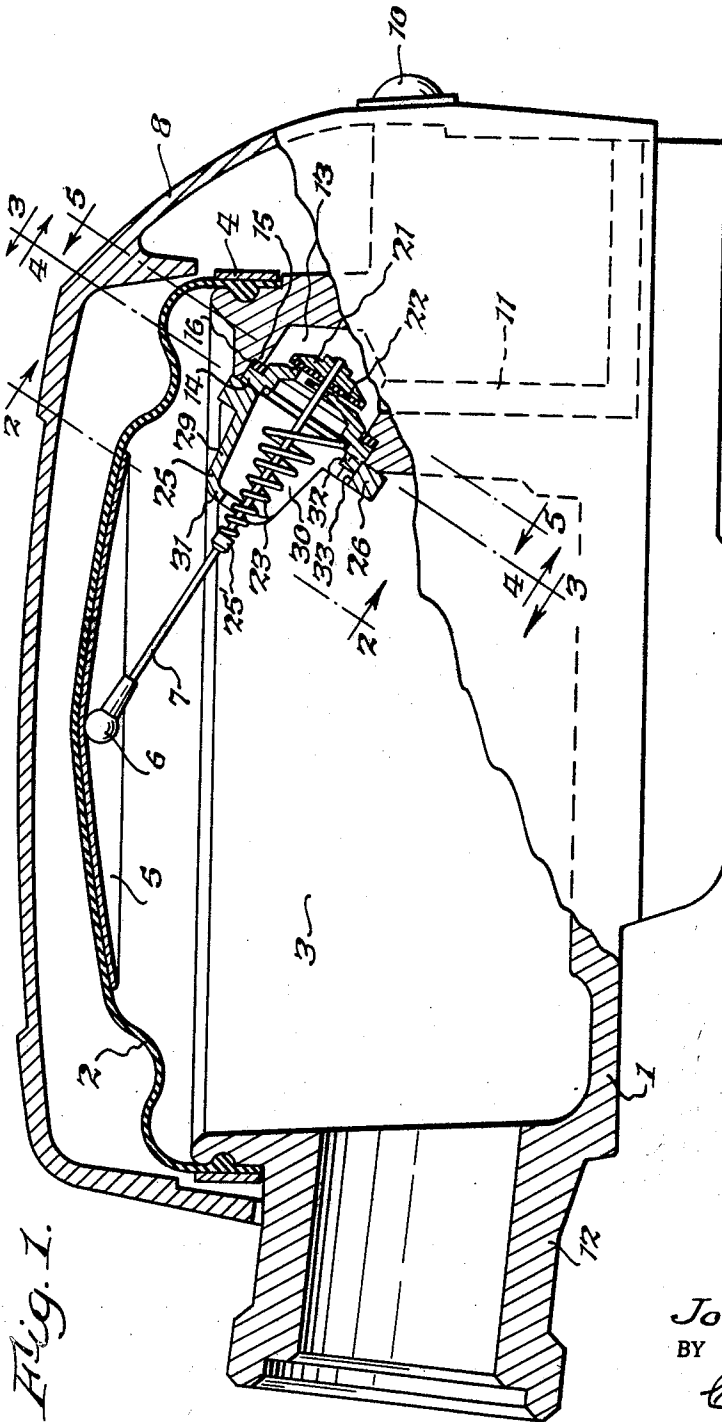
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DEMAND VALVE

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3,493,011



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3,493,011

DEMAND VALVE

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4 Claims

ABSTRACT OF THE DISCLOSURE

A demand valve having an inlet orifice communicating with a breathing chamber defined in part by a flexible diaphragm and a flow director coaxing with said orifice tending to further increase the pressure differential moving said diaphragm into said chamber upon fluid flow through said orifice thereby assisting in further opening the valve.

This invention relates to the protective breathing field, and more specifically to a new and useful valve arrangement in a pressure regulator for controlling the passage of breathing fluid on demand.

It is important in apparatus of this type that the effort required to be exerted by the user be reduced to a minimum, as close to a normal breathing effort as possible. It is also desirable to provide a high flow of breathing fluid immediately on demand, thereby satisfying the demand for breathing fluid as rapidly as possible.

Accordingly, a primary object of this invention is to provide a demand valve requiring a relatively low cracking force, providing a relatively high flow of breathing fluid immediately upon being cracked open and which tends to assist the user in further opening the valve upon initial cracking thereof.

Another object of this invention is to accomplish the foregoing in a relatively simple, durable and dependable manner.

Breathing apparatus constructed in accordance with the instant invention is characterized by the provision of a demand valve having a generally semi-circular orifice into a breathing chamber defined in part by a flexible diaphragm, a valve body engaging an orifice sealing surface and having a stem projecting into the chamber for movement by the diaphragm in a plane, the orifice being generally symmetrical about that plane and positioned generally between the stem and the diaphragm, and a flow director on the chamber side of the orifice, the director having a top wall positioned between the valve stem and the diaphragm and opposite side walls defining with the top wall a generally U-shaped hood inverted relative to the diaphragm and directed across the diaphragm to the fluid outlet.

The foregoing and other advantages and characterizing features of the demand regulator of this invention will become clearly apparent from the ensuing detailed description of the illustrative embodiment thereof depicted in the accompanying drawing wherein like reference numerals denote like parts throughout the various views and wherein:

FIG. 1 is a view partly in section and partly in side elevation, showing a demand regulator of this invention;

FIG. 2 is an end view of the fluid flow director thereof, taken about on line 2—2 of FIG. 1 with all but the director and its attaching screws omitted for greater clarity and ease of illustration;

FIG. 3 is a similar, opposite end view thereof, taken about on line 3—3 of FIG. 1;

FIG. 4 is an end view of the valve seat disc, taken about on line 4—4 of FIG. 1 and with all but the valve seat disc omitted for greater clarity and ease of illustration; and

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FIG. 5 is a similar, opposite end view thereof, taken about on line 5—5 of FIG. 1.

Referring now in detail to the embodiment depicted by way of illustration in the accompanying drawing, there is shown a regulator having a hollow casing 1. A flexible diaphragm 2 is secured across the open side of casing 1 to define a breathing chamber 3 therein. Diaphragm 2 can be secured in place by any desired means, including for example a locking band 4, and has a reinforcing wear plate 5 engaging the outer end 6 of a tilt valve stem 7. A cover 8 is secured to casing 1, as by screws, one of which is shown at 10, and provides a protective cover enclosing diaphragm 2. Casing 1 is provided with an inlet passage 11 adapted for connection to a source of breathing fluid under pressure, not shown, and an outlet 12 adapted for communication with the breathing mask of the user.

Thus, upon demand, that is, upon inspiration by the user the pressure in chamber 3 will be lowered relative to the ambient atmospheric pressure acting externally on diaphragm 2, thereby causing diaphragm 2 to move inwardly of chamber 3, tilting valve stem 7 in the plane of the paper.

Fluid inlet 11 opens into an inlet chamber 13 connecting with breathing chamber 3 through a valve disc generally designated 14. Valve disc 14 seats against a shoulder 15, with a sealing gasket 16 interposed therebetween. Disc 14 is dished, inwardly of chamber 13, and has a semi-circular kidney-shaped fluid orifice 17 therethrough. Orifice 17 is surrounded by a valve seat having a generally semi-circular portion 18 substantially coincident with the curved outer circumference of orifice 17. The valve seat is completed by a generally rectilinear portion 19 extending crosswise of the opposite ends of orifice 17, between the opposite ends of the curvilinear seat portion 18.

The inner circumference of orifice 17 is defined by a tab 20 apertured to loosely receive stem 7.

A circular valve body 21 is secured to stem 7 at its inner end, and has a suitable sealing material surface 22 seating against the valve seat 18, 19 in sealing engagement therewith. A helical spring 23 encircles stem 7, seating at one end in an annular recess 24 in valve disc 14 and bearing at its opposite end against a stop 25' on stem 7. Spring 23 urges valve body 21 into sealing engagement against seat 18, 19, whereas movement of diaphragm 2 into chamber 3 tilts stem 7 against the restoring action of spring 23 pivoting valve body 21 with its sealing surface 22 centrally on the curvilinear seat portion 18. This opens orifice 17, admitting breathing fluid under pressure from inlet 11, 13 into chamber 3. It is a particular feature of this invention that the fluid flow thus resulting from cracking upon valve 21 is directed and utilized in a manner assisting the user in further opening the valve.

To this end, there is provided a flow director 25 having a base 26 seating on the inner wall surface of casing 1, around and against valve disc 14. Director 25 is secured in position as by screws 27 extending into casing 1, thereby securing the director in position and simultaneously holding valve disc 14 in mounted position.

Director 25 has an opening 28 therethrough, in general alignment with orifice 17, and is formed to provide a hood having a curved top wall portion 29 and opposite side wall portions 30. The director hood therefore is of generally inverted U-shape, as viewed in FIG. 1, with top wall 29 positioned between stem 7 and diaphragm 2. Stem 7 extends between the hood side walls 30, outwardly beyond the hood, with top wall 29 having a down turned outer end 31 terminating short of stem 7 in its centered, rest position.

The axes of orifice 17 and director 25 are inclined upwardly toward diaphragm 2, in the direction of fluid flow, and also toward outlet 12 which is positioned generally opposite inlet orifice 17. The director 25 is positioned and

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anged to direct the incoming fluid flow across diaphragm 2 toward outlet 12. In other words, it does not merely deflect incoming pressure fluid from direct impingement upon the diaphragm. It does more than that, that it directs the fluid flow relative to the diaphragm a manner tending to further increase the pressure differential moving diaphragm 2 into chamber 3. In other words, the high velocity flow of pressure fluid across diaphragm 2 tends to further reduce the pressure acting externally against the diaphragm, thereby assisting in producing further inward movement of diaphragm 2 and further opening of the valve 21. In doing this, the generally inverted U-shape of the director hood is important, cause it acts as a continuation of orifice 17, confining and shaping the incoming pressure fluid in a manner producing the desired result.

The desired alignment between orifice 17 and the director hood is assured by a position lock 32 on valve seat 14 which is received in a recess 33 in the base of director 25. The circular, symmetrical shape of valve body and its sealing surface 22 avoids any need for predetermined angular orientation between the valve body and its seat.

Having fully disclosed and completely described my invention, what I claim as new is:

1. A breathing apparatus having a hollow casing with an opening in one wall thereof, a movable member secured across said opening to define an expansible chamber in said casing, said casing having a fluid inlet communicating with said chamber and adapted for connection to a source of breathing fluid under pressure and a fluid outlet communicating with said chamber, means forming a generally semi-circular orifice between said fluid inlet and said chamber at a position generally opposed to said fluid outlet across said chamber, valve means operably associated with said orifice for controlling the flow of breathing fluid therethrough into said chamber, said valve means including a valve body and a valve seat having an orifice sealing surface on the inlet end of said orifice remote from said chamber, said movable member being responsive to variations in differential pressure within and without said chamber, a valve stem projecting from said valve body into said chamber for movement by said member in a plane tilting said valve body on

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said valve seat to open the fluid passage through said orifice upon movement of said member into said chamber, said orifice being generally symmetrical about said plane and positioned generally between said stem and said member, and a fluid flow director on the chamber side of said orifice, said director having a top wall positioned between said valve stem and said member and opposite side walls defining with said top wall a generally U-shaped hood inverted relative to said member and directed thereacross to said fluid outlet, said director and said orifice coacting in a manner tending to further increase the pressure differential moving said member into said chamber upon fluid flow through said orifice thereby assisting in further opening of said valve means.

2. A breathing apparatus as set forth in claim 1, wherein said movable member is a flexible diaphragm.

3. A breathing apparatus as set forth in claim 2, wherein said orifice and said flow director are inclined relative to said diaphragm in the direction of said fluid outlet.

4. A breathing apparatus as set forth in claim 2, wherein said valve seat has a generally semi-circular portion aligned with said orifice and joined at the opposite ends thereof by a generally flat portion extending generally normal to said plane, said orifice being defined in part by a tab bisected by said plane and extending generally from said flat seat portion toward the mid-point of said semi-circular seat portion, said tab being spaced from said semi-circular seat portion to define the inner circumference of said orifice and being apertured to receive said valve stem.

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